Natural Resources Conservation Service

Collaborative Efforts Towards Soil Health in the Caribbean Area:

a historical review

Edwin G. Más & Carlos Ortíz
USDA NRCS, UPR Mayagüez

Deforestation

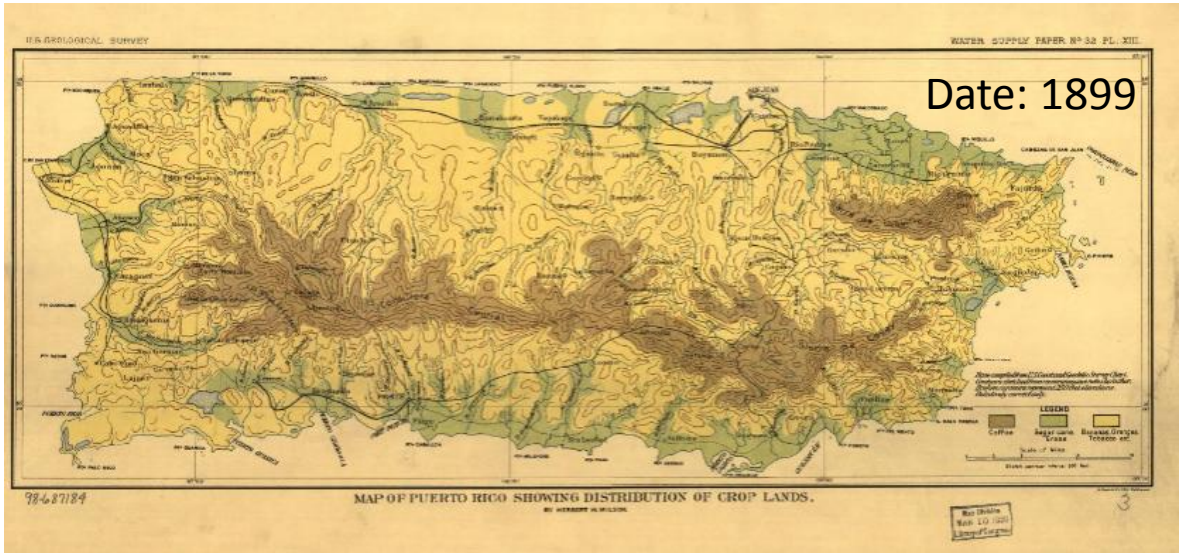
- Extensive deforestation for agriculture began on Puerto Rico with European colonization (1500s) and continued until the early 1950s when it was estimated that the island was 96% deforested (Wadsworth, 1950; Birdsey and Weaver, 1982).
- The forests of the U.S. Virgin Islands also experienced a colonial period of deforestation for export agriculture followed by forest recovery (Weaver, 2006a,b).

Gully erosion in PR

Deforestation for industrial-scale agriculture and subsistence agriculture dominated the Islands for decades.

Saint Croix, USVI Sugarcane fields for sugar and molasses

Puerto Rico showing distribution of croplands

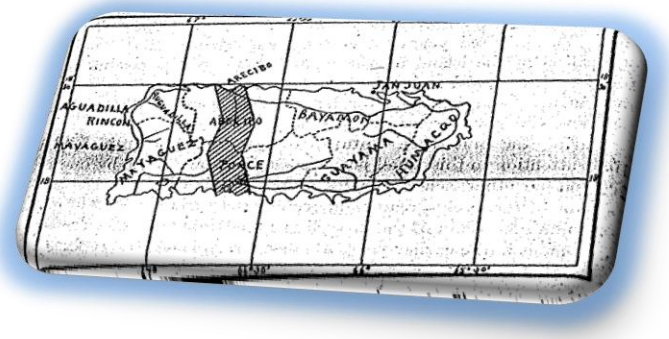


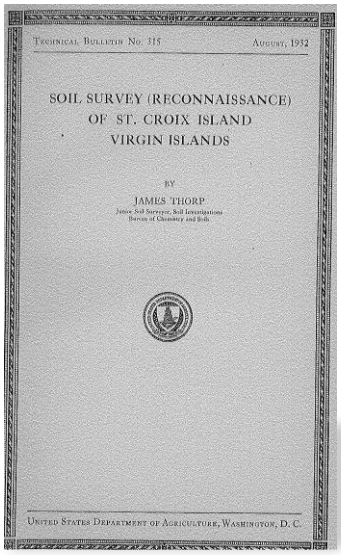
Banana, Oranges, Tobacco

Sugarcane, Grass

Coffee

Before SCS* in the Caribbean Area




TECHNICAL BULLETIN No. 315 AUGUST, 1932

SOIL SURVEY (RECONNAISSANCE)
OF ST. CROIX ISLAND
VIRGIN ISLANDS

BY
JAMES THORP

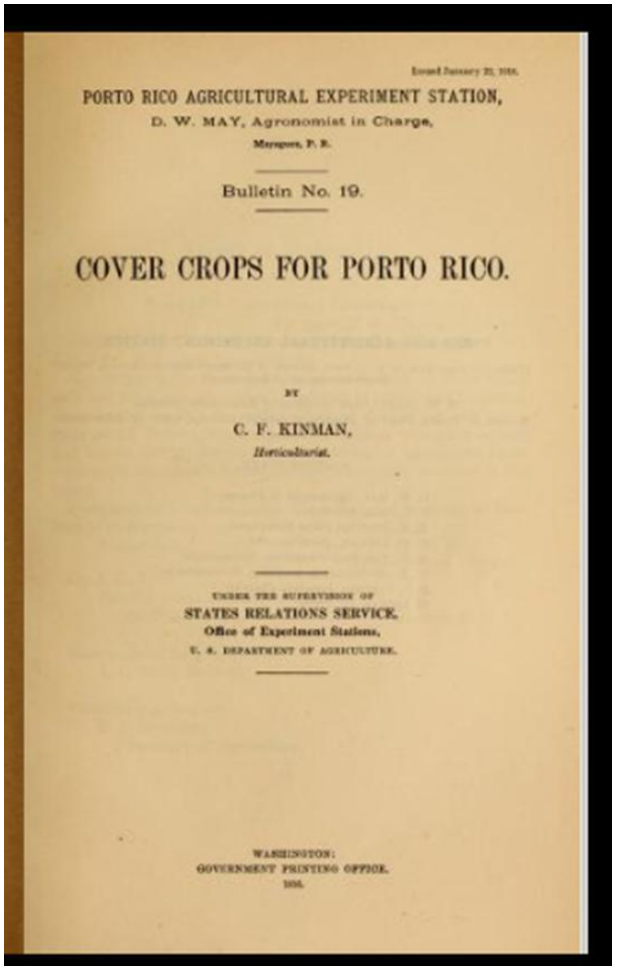
UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

1903. First Soil Survey. *Soil Survey from Arecibo to Ponce Porto Rico* USDA.

1932. USDA Publication: Soil Survey (Reconnaissance) of St. Croix Island, USVI

*Soil Conservation Service

1916. USDA Bull. 19. Cover Crops for Puerto Rico



PORTO RICO AGRICULTURAL EXPERIMENT STATION,
D. W. MAY, Agronomist in Charge,
Mayaguez, P. R.

Bulletin No. 19.

COVER CROPS FOR PORTO RICO.

BY

C. F. KINMAN,
Horticulturist.

UNDER THE SUPERVISION OF
STATES RELATIONS SERVICE,
Office of Experiment Stations,
U. S. DEPARTMENT OF AGRICULTURE.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1916.

Porto Rico Agricultural Experiment Station

Bulletin N0. 19

COVER CROPS FOR PORTO RICO

US Department of Agriculture

1916

Creation of SCS

1935, April 27th. President F. D. Roosevelt approves the Soil Conservation Law No.46-74. Creation of the **Soil Conservation Service (SCS).**

1935. George L. Crawford, was designated in charge of SCS in PR & USVI. There were 731,648 cultivated acres in PR.

President F. D. Roosevelt

SCS in PR & USVI

1936. Establishment of Civilian Conservation Corps Camp (CCC) at Cerro Las Mesas, Mayagüez. 200 persons working and learning farming in 35% slopes.

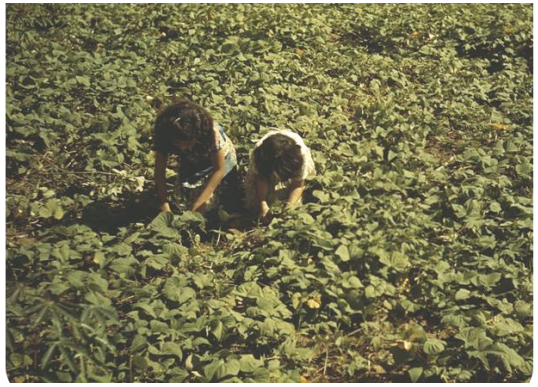
1936. Establishment of the: *Comité Consejero de Conservación de Suelos,* de PR (Today known as the State Technical Committee).

SCS in PR & USVI

1938:

- **34 miles of outlet channels**
- **73 miles of hillside ditches**
- **551 miles of diversion terraces**
- **93 miles of vegetative barriers**
- **7,276 miles of contour tillage**

Contour bench terraces at the Soil Erosion Station, Mayagüez. “Las Ochenta Farm”. 1936-38



Cultivating legumes for food and cover. USVI, 1939

SCS in PR & USVI

1938 (June 1). Start field works in Soil Erosion at the Soil Erosion Station, Mayagüez & Agricultural Experiment Station, Río Piedras. (sweet potatoes, sugar cane, pumpkin, tobacco) and soil stabilization. Some of the work was:

- Growth habit and nutritional value of forages
- Sediment/Runoff water
- Terracing
- Vegetative barriers

Plots to measure soil erosion at Soil Erosion Station, Mayagüez, PR. (Finca Las Ochenta, adjacent to PR Zoological Park)
35-42% slope, 51.86’ X 12’ (0.70 acre)

SCS in PR & USVI

1945. SCS manage demonstration projects at the Soil Erosion Station, Mayagüez (TARS), on cover crops and grazing.

Tropical Kudzu for slope stabilization and forage.

Caribbean Soil Survey Areas

11. (1995) - Luquillo Long-Term Ecological Research Grid

1. (1902) - Arecibo to Ponce Reconnaissance Survey

12. (2000) – Camp Santiago and Fort Allen

2. (1932) - St. Croix Island Reconnaissance Survey

13. (2002) - Caribbean National Forest and Luquillo Experimental

3. (1942) – Puerto Rico Soil Survey –R.C. Roberts

14. (2002) – Soil Survey of United States Virgin Islands

4. (1965) – Lajas Valley

15. (2008) – Soil Survey of San Germán Area

5. (1970) – Virgin Islands of the US

16. (2012) – Soil Survey of El Yunque National Forest

6. (1975) – Mayaguez

7. (1977) – Humacao

8. (1978) - Soil Survey of San Juan

9. (1979) – Soil Survey of Ponce

10. (1982) – Soil Survey of Arecibo

1946. Foundation of PR Conservation Districts

1965. USVI Soil & Water Conservation District Foundation

1994. October 20th. **The "Department of Agriculture Reorganization Act" creates NRCS**

Mission
Helping People Help the Land

Vision
Productive Lands – Healthy Environment

We are not alone…

NGO's


1994 -
present

Conservation practices EQIP & Technical Assistance (2010-2016)* with visible effects on soil health

State Puerto Rico	Resource Concern	Obligation Amount ($)	Contracted Acres EQIP	Acres CTA
2010	Organic Matter Depletion and Compaction	964,335.81	2559.1	
2011		1,912,203.89	2802.5	
2012		831,790.65	3724.54	
2013		1,090,895.72	5582	
2014		1,066,094.19	3650.59	
2015		1,166,749.59	3673	
2016		403,327	979.2	
Puerto Rico & USVI		**7,435,396.85**	**22,970.93**	**46,533.07**

*Practices applied 2010-April 2016 **Environmental Quality Incentive Program EQIP**: Conservation cover (777), Crop rotation(10,600), Conservation tillage-Residue (1,277), Cover crops (125), Critical area planting (35), Multistory-Shade coffee (2,000), Windbreaker (175), Silvopasture (1), Field border (14), Riparian forest buffer(500), Filter strip (20), Forage and biomass planting (4,000), Prescribed grazing (50,000).

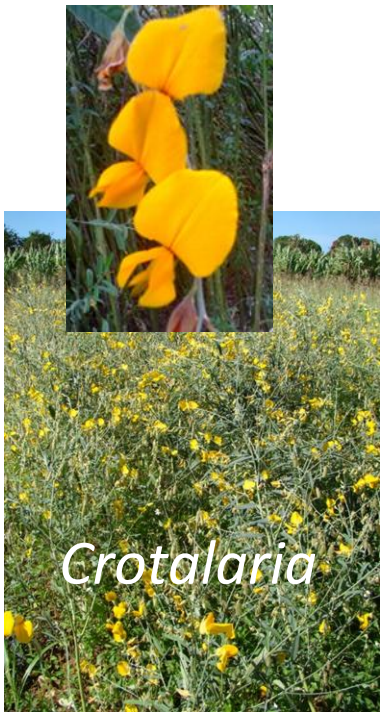
Soil health… something you can see, smell, feel, taste, hear

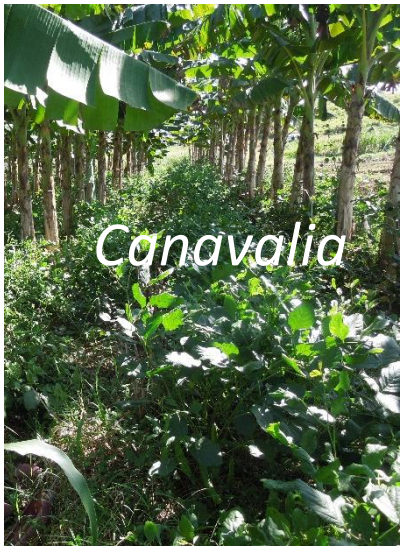
See: in a healthy soil ecosystem, plants and products
Smell: a fresh healthy soil
Feel: with your hands
Taste: healthy fruits, vegetables and animal products
Hear: through a bird singing in a healthy forest

2. Geophila macropoda in bananas

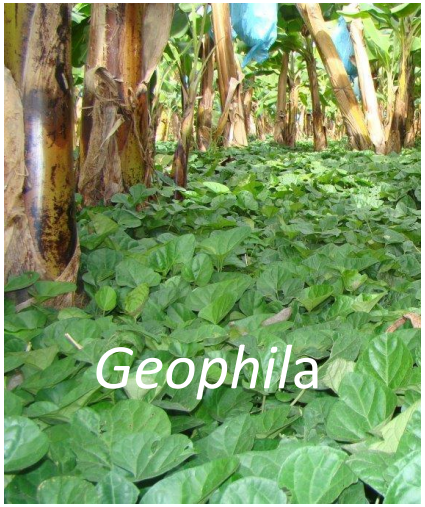
Cover crops: planted for seasonal vegetative cover
Conservation covers: permanent vegetative cover

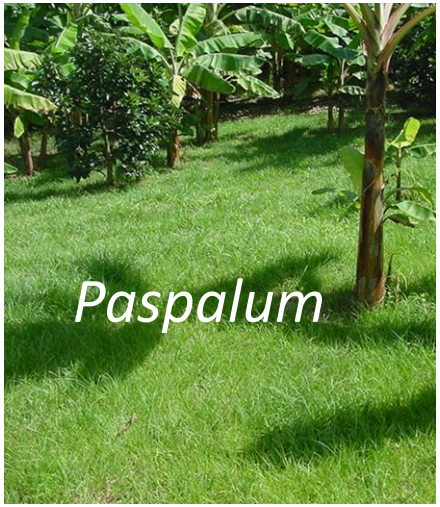
- *Crotalaria, Canavalia, Mucuna*





- G*eophila*, *Bothriochloa, Dichanthium*, *Axonopus* and *Paspalum notatum*





Cover crop *Cotalaria, Sorghum, Melanthera*

Mixture of species for cover crops

Innovative equipment's to establish and harvest in steeplands

- after 120 days averages 1,651 pounds per acre biomass and 54 pounds per acre of nitrogen
- *Crotalaria juncea* produces an allelopathic substance that is toxic to many nematodes, reducing their populations in the soil.
- Reduced fungicide use for Black Sigatoka by 78%;
- Reduced nematicide use by 50%; and
- Reduced herbicide use by 72%.

Conservation cover *Geophila macropoda*

- reduced the use of glyphosate by 83%
- reduced sediment deposition to his drainage canals so much that only needs to maintain them twice a year
- can produce up to 80,000 pounds of green material and 231 pounds of nitrogen per acre
- Reduced watering by 50%

PR & USVI Training to Partners: techniques to establish and manage conservation practices

Silvopasture and fencing

Riparian Forest Buffer

Monarch. *Danaus plexippus portorricensis*, non-migrant

Water Quality/Quantity and Habitat for pollinators

Forage and biomass establishment and Grazing management

Managing Irrigation systems

Managing animal byproducts and Nutrient management

Weed and pest control

Windbreakers

Shade coffee (Multistory: trees for shade and wildlife habitat enhancement)

Tillage-Residue management

Alley cropping (avocados and hay)

Filter strip/Vegetative barrier (vetiver grass) and mulch in crop rotations

Mulching orchards

Crop rotation and contour farming

Conservation cover and planting pattern in breadfruit (panapén)

Plant Materials Program

Project	$ (NRCS)
Spatial Distribution of Vegetation in Undisturbed Salt Flats in Southern Puerto Rico	20,000
Native tree/shrub species for reforestation	60,000
Adaptation and application of native grass *Uniola virgata* for conservation purposes for soil erosion control, sediment control, wildlife habitat enhancement, water quality improvement.	28,000
Propagation of salflat vegetation for conservation buffers	20,000
Validation, demonstration, adoption and trends of cover crops & effects on crops	25,000
USVI Tropical cover crops and **multipurpose N-fixing trees** to reduce soil erosion, increase soil quality and provide ecosystem services in Caribbean agroecosystems.	17,000
USVI Cover crops conservation covers technology transfer	15,000
Total	**$187,000**

Uniola virgata. Erosion control and habitat enhancement in dry calcareous coastal soils

Saltflat vegetation for conservation buffers

Individual terrace

CIG-Conservation Innovation Grants 2006-2016

Project	$
Promoting the use of tropical legumes as cover crops and for prescribed grazing in Puerto Rico	120,000
Sustainable Coffee Production in Puerto Rico (shade trees)	60,000
Sustainable Pasture Production Using Dairy Manure and Innovative Liquid Inorganic Fertilizer Source in Puerto Rico	120,000
Vermiculture: an alternative of conservation	51,000
Field Validation and Demonstration of Bahiagrass as Living Mulch for Erosion Control in Perennial Crops and on Dirt Road Shoulders	18,000
Validation and demonstration of covered aerated static pile composting of coffee residues	150,000
Production of vermicompost and related products via resources recovery two stage organic material transformation system	150,000
Establishment of salt flat tolerant vegetation as conservation buffers to help retain potential pollutants entering into marine environments	150,000
Promoting organic agriculture in Puerto Rico through organic seed production and grower education (*Crotalaria juncea*), velvet bean (*Mucuna pruriens*), cowpea (*Vigna unguiculata*), and jack bean (*Canavalia ensiformis*)	140,000
Innovative Soil Health Management System for commercial scale plantain production	150,000
Demonstrate, quantify and validate the effectiveness of compost as soil amendment	40,000
Tree sourcebook: "Best Practices Supporting Conservation Efforts	150,000
Intercropping with *Moringa oleifera*: Demonstration and Outreach	20,000
Cover Crops propagation for efficient plant production system and improving soil health in Puerto Rico	60,000
TOTAL	**$ 1,379,000**

OUR COMMITMENT

June 2016. USDA Secretary Tom Vilsack announced several measures to strengthen rural opportunity in Puerto Rico


USDA NRCS
Caribbean Area Employees 2011
unlock the
SECRETS
IN THE
SOIL

History of SCS NRCS in the Caribbean Area, Farm Bill, Conservation practices, Programs, Financial assistance, Technical assistance, Soils, Plants, Publications (Brochures, Guides), Outreach, Strikeforce for Rural Growth and Opportunities, Local Offices

http://www.nrcs.usda.gov/wps/portal/nrcs/site/pr/home/

Historical pictures: Library of the Congress
https://www.google.com/#q=library+of+the+congress

- In accordance with Federal civil rights law and U.S. Department of Agriculture (USDA) civil rights regulations and policies, the USDA, its Agencies, offices, and employees, and institutions participating in or administering USDA programs are prohibited from discriminating based on race, color, national origin, religion, sex, gender identity (including gender expression), sexual orientation, disability, age, marital status, family/parental status, income derived from a public assistance program, political beliefs, or reprisal or retaliation for prior civil rights activity, in any program or activity conducted or funded by USDA (not all bases apply to all programs). Remedies and complaint filing deadlines vary by program or incident.

- Persons with disabilities who require alternative means of communication for program information (e.g., Braille, large print, audiotape, American Sign Language, etc.) should contact the responsible Agency or USDA's TARGET Center at (202) 720-2600 (voice and TTY) or contact USDA through the Federal Relay Service at (800) 877-8339. Additionally, program information may be made available in languages other than English.

- To file a program discrimination complaint, complete the USDA Program Discrimination Complaint Form, AD-3027, found online at How to File a Program Discrimination Complaint and at any USDA office or write a letter addressed to USDA and provide in the letter all of the information requested in the form. To request a copy of the complaint form, call (866) 632-9992. Submit your completed form or letter to USDA by: (1) mail: U.S. Department of Agriculture, Office of the Assistant Secretary for Civil Rights, 1400 Independence Avenue, SW, Washington, D.C. 20250-9410; (2) fax: (202) 690-7442; or (3) email: program.intake@usda.gov.

- USDA is an equal opportunity provider, employer, and lender.